



## Thermodynamics of hydration of MX80 smectite derived from hydration isotherms

Hélène Gailhanou, Philippe Blanc, Arnault Lassin, Philippe Vieillard, Renaud Denoyel, E. Bloch, Benoît Madé, Eric Giffaut

### ► To cite this version:

Hélène Gailhanou, Philippe Blanc, Arnault Lassin, Philippe Vieillard, Renaud Denoyel, et al.. Thermodynamics of hydration of MX80 smectite derived from hydration isotherms. Goldschmidt 2013, Aug 2013, Florence, Italy. hal-00834004

**HAL Id: hal-00834004**

**<https://hal-brgm.archives-ouvertes.fr/hal-00834004>**

Submitted on 13 Jun 2013

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Please ensure that your abstract fits into one column on one page and complies with the *Instructions to Authors* available from the Abstract Submission web page.

## **Thermodynamics of hydration of MX80 smectite derived from hydration isotherms**

H. GAILHANOU<sup>1\*</sup>, P. BLANC<sup>1</sup>, A. LASSIN<sup>1</sup>, P. VIEILLARD<sup>2</sup>, R. DENOYEL<sup>3</sup>, E. BLOCH<sup>3</sup>, B. MADÉ<sup>4</sup> AND E. GIFFAUT<sup>4</sup>

<sup>1</sup> BRGM, BP36009, 45060, Orléans, France  
(\*correspondence : [h.gailhanou@brgm.fr](mailto:h.gailhanou@brgm.fr))

<sup>2</sup> CNRS-IC2MP-UMR-7285 Hydrasa, 86022, Poitiers, France, [philippe.vieillard@univ-poitiers.fr](mailto:philippe.vieillard@univ-poitiers.fr)

<sup>3</sup> LCP UMR-CNRS-6264, 13397, Marseille, France  
([renaud.denoeyel@univ-amu.fr](mailto:renaud.denoeyel@univ-amu.fr))

<sup>4</sup> ANDRA, 92298, Châtenay-Malabry, France  
([Benoit.Made@andra.fr](mailto:Benoit.Made@andra.fr))

Hydration energies contribute significantly to the stability of hydrated clay minerals. However, thermodynamic data of hydration for clay minerals are still poorly known. The present study aims to improve our comprehension of the hydration processes of sodic smectite MX80, and to implement a new methodology for extracting thermodynamic data of hydration of the smectite.

A first approach consists in applying a global hydration model to extract the thermodynamic data of total adsorbed water (G, H and S) from adsorption/desorption isotherms at 25°C and 45°C. The results are in good agreement with calorimetric data at 84 and 91% RH, from [1]. As capillary water, which is present in the intergranular porosity of the clay sample, does not contribute to the thermodynamic stability of the hydrated clay mineral, a refined calculation method has then been implemented to discriminate hydration water from capillary water in the total adsorbed water. The so called “hydration water” refers to interlayer water and surface recovering water of the smectite. Contrary to capillary water, the amount of hydration water depends on the nature of the smectite (nature of interlayer cations, layer charge and location of the charge). The thermodynamic properties of capillary water are calculated after [2]. The present method allows (i) to estimate the respective amounts of hydration and capillary waters and (ii) calculate the energies of formation of the hydration water.

This work is to be extended to other hydrated clay minerals in order to refine the solid solution model from [3] and to finally provide a global predictive model for clay mineral hydration energies.

[1] Gailhanou et al. (2012) GCA **89**, 279-301. [2] Lassin et al. (2005) GCA **69**, 5187-5201. [3] Vieillard et al. (2011). GCA **75**, 5664-5685.